

**WHAT IS CLAIMED IS:**

1. An illumination optical system for  
illuminating a mask that arranges a predetermined  
5 pattern and an auxiliary pattern smaller than the  
predetermined pattern using light from a light source,  
said illumination optical system comprising:

an illumination-light generating mechanism  
for dividing the light and for forming a quadrupole  
10 light intensity distribution around an optical axis on  
a surface that has substantially a Fourier conversion  
relationship with the mask, so as to resolve the  
predetermined pattern and restrain the auxiliary  
pattern from resolving,

15 wherein at least one of a size of each pole  
of the quadrupole light intensity distribution and a  
distance between the optical axis and each pole of the  
quadrupole light intensity distribution are variable.

20 2. An illumination optical system according to  
claim 1, wherein said illumination-light generating  
mechanism includes a prism.

3. An illumination optical system according to  
25 claim 2, wherein the prism includes pyramid surfaces  
that arrange a concave surface at an incident surface  
side and a convex surface at an exit surface side.

4. An illumination optical system according to claim 1, wherein the illumination-light generating mechanism includes a diffraction optical element.

5 5. An illumination optical system according to claim 1, wherein the illumination-light generating mechanism includes:

plural optical elements; and

a switch mechanism for arranging each optical  
10 element on and retreating each optical element from a light path.

6. An illumination optical system according to claim 1, further comprising an illumination-light  
15 deforming mechanism for varying at least one of a size of each pole of the quadrupole light intensity distribution and a distance between the optical axis and each pole of the quadrupole light intensity distribution,

20 wherein the illumination-light deforming mechanism includes plural lenses that have a variable magnification or focal distance.

7. An illumination optical system according to  
25 claim 1, further comprising an illumination-light deforming mechanism for varying at least one of a size of each pole of the quadrupole light intensity

distribution and a distance between the optical axis and each pole of the quadrupole light intensity distribution,

                  wherein the illumination-light deforming  
5 mechanism includes:  
                  first and second optical members; and  
                  a drive mechanism for relatively moving the  
first and second optical members in an optical-axis  
direction.

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8. An illumination optical system according to claim 7, wherein each of the first and second optical members is a prism.

15 9. An illumination optical system according to claim 1, wherein each pole of the quadrupole light intensity distribution has a variable shape.

20 10. An exposure apparatus comprising:  
an illumination optical system for  
illuminating a mask using light from a light source,  
said mask arranging a predetermined pattern and an  
auxiliary pattern smaller than the predetermined  
pattern; and

25 a projection optical system for projecting  
light from said illumination optical system onto an  
object to be exposed,

wherein said illumination optical system includes an illumination-light generating mechanism for dividing the light and for forming a quadrupole light intensity distribution around an optical axis on a predetermined surface that has substantially a Fourier conversion relationship with the mask, so as to resolve the predetermined pattern and restrain the auxiliary pattern from resolving, wherein at least one of a size of each pole of the quadrupole light intensity distribution and a distance between the optical axis and each pole of the quadrupole light intensity distribution are variable.

11. An exposure apparatus comprising:  
an illumination optical system for illuminating a mask using light from a light source, said mask arranging a predetermined pattern and an auxiliary pattern smaller than the predetermined pattern; and

a projection optical system for projecting light from said illumination optical system onto an object to be exposed, said projection optical system including a pupil,

wherein said illumination optical system includes an illumination-light generating mechanism for dividing the light and for forming a quadrupole light intensity distribution around an optical axis on a

predetermined surface that has substantially a Fourier conversion relationship with the mask, so as to resolve the predetermined pattern and restrain the auxiliary pattern from resolving, wherein a distance between  
5 barycenters of two facing poles of the quadrupole light intensity distribution is variable between 0.32 and 0.90 where a diameter of the pupil in the projection optical system is assumed to be 1.

10 12. A device fabricating method comprising the steps of:

exposing an object using an exposure apparatus; and

15 performing a predetermined process for the object that has been exposed,

wherein the exposure apparatus includes:

an illumination optical system for illuminating a mask using light from a light source, said mask arranging a predetermined pattern and an  
20 auxiliary pattern smaller than the predetermined pattern; and

a projection optical system for projecting light from said illumination optical system onto an object to be exposed,

25 wherein said illumination optical system includes an illumination-light generating mechanism for dividing the light and for forming a quadrupole light

intensity distribution around an optical axis on a predetermined surface that has substantially a Fourier conversion relationship with the mask, so as to resolve the predetermined pattern and restrain the auxiliary  
5 pattern from resolving, wherein at least one of a size of each pole of the quadrupole light intensity distribution and a distance between the optical axis and each pole of the quadrupole light intensity distribution are variable.

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13. A device fabricating method comprising the steps of:

exposing an object using an exposure apparatus; and

15 performing a predetermined process for the object that has been exposed,

wherein the exposure apparatus includes:

an illumination optical system for illuminating a mask using light from a light source,  
20 said mask arranging a predetermined pattern and an auxiliary pattern smaller than the predetermined pattern; and

a projection optical system for projecting light from said illumination optical system onto an  
25 object to be exposed, said projection optical system including a pupil,

wherein said illumination optical system includes an illumination-light generating mechanism for dividing the light and for forming a quadrupole light intensity distribution around an optical axis on a  
5 predetermined surface that has substantially a Fourier conversion relationship with the mask, so as to resolve the predetermined pattern and restrain the auxiliary pattern from resolving, wherein a distance between two facing poles of the quadrupole light intensity  
10 distribution is variable between 0.32 and 0.90 where a diameter of the pupil in the projection optical system is assumed to be 1.